# HAWAIYA TECHNOLOGIES, LLC

*a Small Minority & Veteran Owned Business*

# Hawaii Homeland Security Command Information System (H2S CIS)

## ADVANCED CONCEPTS STUDY (ACS)

**Prepared for:**

**Hawaii State Civil Defense**
**3949 Diamond Head Road**
**Honolulu, Hawaii 96816**

**Prepared by:**

**Hawaiya Technologies, LLC**

**1305 Makiki Street, Suite 705**
**Honolulu, Hawaii 96814**

# H2S CIS ADVANCED CONCEPTS STUDY

## TABLE OF CONTENTS

# TABLE OF FIGURES

## Introduction

This Advanced Concepts Study was prepared by Hawaiya Technologies for the Hawaii Homeland Security Command Information System (H2S-CIS) awarded as a cooperative agreement between the Department of Defense Civil Defense Division (State Civil Defense) and Hawaiya Technologies, LLC under grant award 2004-GR-TA-K010 by the Department.

The purpose of this study was to project, beyond the term of the grant and through additional funding, potential add-ons capability and functionality to the base H2S CIS specific to sensors, mission planning system integration capabilities and improvement and enhancement of operator collaboration tools.

The three areas addressed in this study are:

❖ Include National Oceanographic and Atmospheric Administration (NOAA) automated weather input
❖ Incorporate Unmanned Aerial Vehicle (UAV) sensor data into H2S-CIS/EOC
❖ Expand sensor coverage over a wider geographic area
❖ Port EOC situational awareness information to the various first responder/law enforcement command centers located throughout the state
❖ Include other Critical Infrastructure Surveillance Systems into H2S-CIS, e.g., Board of Water Supply, Sewage Treatment Plants, designated emergency food distribution centers
❖ Mission Planning System
❖ Operator Collaboration Tools

- Advanced Sensors
- Weather system
- Mission Planning System
- Operator Collaboration Tools

# Advanced Sensors

The deployment of technical sensors to detect specific categories of weapons that may be used in a terrorist attack is a security requirement for every urban environment. The H2S CIS project is uniquely positioned to be able to integrate additional, disparate sensors, transmit those sensor data securely back to a central command center and fuse this data, providing command and control decision support information. This study gives an overview of some of the "cutting edge" sensors, value, utilization and capabilities that could be integrated in the H2S CIS in the future.

"Technical sensors" are embedded in an exceptionally wide variety of systems and technologies but their common purpose is to detect weapons or materials, either before they are used by terrorists or during the onset of an attack. Possible targets need to be protected from all forms of catastrophic threats. The U.S. Government and private industry are investing what is necessary to protect against these catastrophic threats. There are five categories of weapons that are generally recognized as the most imminent threats in a terrorist attack; chemical, biological, radiological, nuclear and explosives (CBRNE).

There is enormous variation within each of the five weapon categories but it is possible to make few general comparisons across the categories. Two key parameters for evaluating threats are (1) the probability that a particular weapon will be used in a terrorist attack, and (2) the consequences of the successful use of that particular weapon in a terrorist attack. The diagram below illustrates the range of probabilities and consequences associated with the five categories of weapons under discussion here.

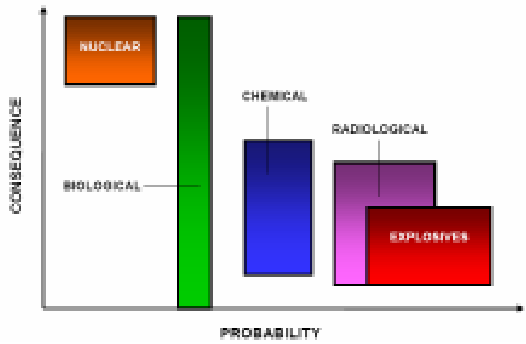



**Figure 1: Five Categories of Weapons**

In terms of the severity of consequences, the threat of a terrorist attack against the homeland involving **a nuclear or biological weapon** is the most worrisome scenario facing the United States today. A nuclear or a biological attack could cause loss of life and economic damage well beyond that experienced on September 11, 2001.

An attack involving chemical, radiological, or explosive weapons could also cause significant loss of life and grave economic consequences, though not on the scale of a nuclear or high-end biological attack.

These five types of weapons are attractive to terrorists looking to carry out attacks against U.S. interests. Each weapon can be countered, in some measure and degree, by the use of sensors.

- **Chemical Weapons**: Chemical weapons are gaseous, liquid, or solid chemical substances which have direct toxic effects on man and animals. There are several classes of chemical weapons. The most lethal chemical warfare agents are nerve agents such as sarin and VX, which kill by poisoning the nervous system and disrupting bodily functions. Blood agents, such as hydrogen cyanide and chlorine, prevent the normal use of oxygen by the body tissues so that vital organs cease to function within minutes. Vesicants, such as mustard gas, cause extreme, potentially lethal burning or stinging of eyes and skin. Pulmonary agents, such as phosgene, damage and flood the respiratory system, causing suffocation. Certain industrial chemicals and pesticides are suitable for use as improvised chemical weapons.

In defending against chemical terrorism, the role of sensors optimized for chemical weapons is principally to detect when an attack has occurred and to identify which agent has been used so that appropriate evacuation, containment, and medical treatment steps can be taken. Before an attack has occurred, the emission of a detectable signal from a chemical weapon will usually mean that it is leaking – and thus that it is exposing its purveyor to the toxic effects of the chemical agent.

- **Biological Weapons**: Biological weapons employ disease-causing organisms (principally bacteria and viruses), or toxins produced by living organisms, to incapacitate or kill human beings and animals or to destroy crops. Biological weapons (except for toxins) usually have delayed effects because they work by causing particular kinds of diseases which incubate in the body, often imperceptibly, over a period of days or weeks. Biological agents can be distributed through the air, through consumed food and liquid, or directly into the bloodstream. Microscopic quantities of a biological agent are often sufficient to cause massive infection.

As is the case with chemical weapons, passive sensors have relatively little chance of detecting a biological agent while it is still weaponized – that is, before it has been released into the atmosphere or food supply. Biological weapons sensors are essentially devices that can detect the presence of disease-causing organisms and, in the best case, precisely identify the organism. Sensors can take many different forms – from atmospheric samplers to medical swabs to hand-held devices – but their basic value is to alert officials that an attack has occurred so that appropriate evacuation, containment, and medical treatment steps can be taken. With adequate warning, the range of post-attack treatment options is far greater for biological weapons than it is for chemical weapons due to the relatively long incubation periods of biological weapons and their susceptibility to medical countermeasures.

- **Radiological Weapons**: Also known as a "dirty bomb," a radiological weapon is designed to disperse radioactive material over an area, most likely by means of explosive detonation. Any type of radioactive material could be used in a radiological weapon, including relatively common isotopes such as cesium-137 and spent nuclear fuel.

Immediate casualties in a radiological attack are most likely to result from the explosion used to disperse the radioactive material. The health effects on the individuals exposed to the radiation will most likely develop over a period of days, weeks, or months. Radiological weapons will, however, contaminate an area, possibly rendering it unsafe for human occupation. The psychological terror involved with this crisis typically exaggerates the health risks. In contrast to chemical and biological weapons, radiological weapons may well emit a substantial signal that can be detected by appropriate sensors, thereby opening the possibility that a sensor system could contribute to preventing an attack before it occurs.

- **Nuclear Weapons**: A nuclear weapon releases enormous quantities of energy through a chain reaction of splitting plutonium or highly enriched uranium atoms (fission) or combining hydrogen atoms (fusion). In the event of an attack, the released energy, taking the form of heat, would ignite all nearby flammable substances; pressure would knock down nearby structures; and radiation would cause a variety of adverse health effects. Fusion weapons are generally more destructive and complex than fission weapons. It is conceivable that a non-state actor could fabricate an improvised fission weapon, but fusion weapons are generally thought to be an exclusive purview of states. Since all fission weapons contain plutonium or highly enriched uranium, most passive nuclear weapons sensors are designed to detect the radioactive signature of one of these two elements.

The risk of nuclear materials entering the United States has been a concern for policy-makers since the early days of the Cold War. The nation's nuclear energy agencies and laboratories have invested billions of dollars over the past fifty years to develop the technical capabilities to detect nuclear and radiological sources – either for security risks, health risks, or for remediation purposes. This concern has brought new government attention to the needs for nuclear and radiological detection. The Department of Energy created Nuclear Emergency Support Teams (NEST), elite squads with the mission of detecting nuclear weapons materials in cities, and the U.S. Customs Service began investing in technologies to screen cargo for nuclear and radiological materials.

- **Explosives**: Explosives are unstable materials that can expand suddenly, producing heat and large changes in pressure. There is an extraordinarily wide variety of explosive material, from advanced military explosive such as C-4 and PETN, to gunpowder (potassium nitrate, charcoal and sulph), to simple compounds of ammonium nitrate and diesel fuel. The sheer variety of explosive substances presents major challenges for defensive sensor technology. Explosives are clearly the weapon of choice for terrorists. Most terrorist attacks that result in human casualties involve explosives of one kind or another...

Sensors designed to detect the presence of explosives are usually in-close systems, such as portals, closed containers, and swabs. Properly trained canines are currently the best explosive detection system in the world. Wide area sensors for explosive detection do not appear to be technically feasible. However, the ability to exercise pre-detonation detection necessitates the use of explosive sensor systems throughout ports and other critical infrastructure sites.

While there are thousands of different types of sensors, the following sensors and their technologies are proposed to be integrated into the H2S CIS in the future to mitigate the threat of CBRNE weapons.

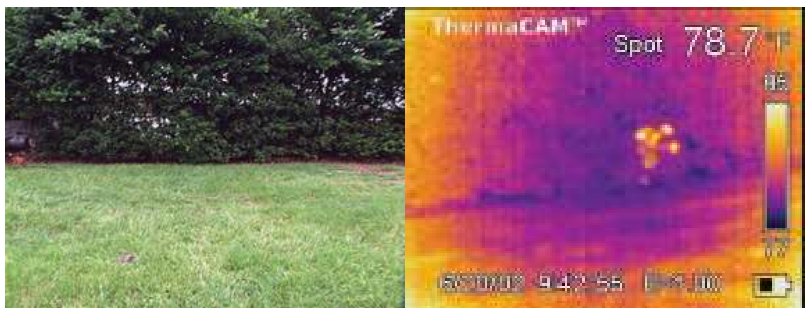
# Types of Sensors and Their Application to H2S CIS

## I. Electro Optical Sensors and Software

Electro Optical (EO) sensors and software exist to perform high-resolution imaging, motion detection, temperature-differentiation and night-vision. There is a variety of EO imaging sensors available including optical video detection systems, using arrays of commercially available CCTV cameras well-suited for daytime surveillance; infrared video (IR) detection systems, that can measure changes in thermal energy and provide night-surveillance; and laser illumination systems that can illuminate targets, and enable higher-resolution imaging when combined with other EO sensors. Additional optical components include computer-operated pan/tilt/zoom cameras, visible or near-infrared illuminators for night vision with conventional cameras; and image-intensifiers for long-range night vision with conventional cameras.

Visible spectrum and infrared cameras can act as sensors to perform surveillance on individuals planting CBRNE devices; hyper spectral optics can be used in sensors to detect and identify objects and biological/chemical species. While the H2S CIS integrated a visible spectrum camera into the initial demonstration project, the addition of infrared and hyper specter cameras and sensors should be considered to significantly increase the surveillance capabilities of the system.

**Infrared Cameras**




*Suspect not visible* *Suspect visible hiding behind hedge*

**Figure 2: Infrared Cameras**

An infrared camera is a non-contact device that detects infrared energy (heat) and converts it into an electronic signal, which is then processed to produce a thermal image on a video monitor and perform temperature calculations. Heat sensed by an infrared camera can be very precisely quantified, or measured. Recent innovations, particularly detector technology, the incorporation of built-in visual imaging, automatic functionality, and infrared software development, deliver more cost-effective thermal analysis solutions than ever before.

Infrared thermography is the use of an infrared imaging and measurement camera to "see" and "measure" thermal energy emitted from an object. Thermal, or infrared energy, is light that is not visible because its wavelength is too long to be detected by the human eye; it's the part of the electromagnetic spectrum that we perceive as heat. Unlike visible light, in the infrared world, everything with a temperature above absolute zero emits heat. Even very cold objects, like ice cubes, emit infrared. The higher the object's temperature, the greater the IR radiation emitted. Infrared allows us to see what our eyes cannot.

**Hyper/Multi Spectral Optics**

Imaging spectroscopy, also known as hyper or multi spectral remote sensing, allows a sensor to gather reflected radiation from a target based on color. With such detail, the ability to detect and identify individual objects greatly improves. This technology is also used to detect biological/chemical species and can be integrated into sensors to monitor for biological and chemical threats.

**Smart Camera Software**

One smart camera can do the work of multiple sensors with more limited capabilities.

**Object Behavior Targeting** **Distributed Smart Cameras**

**Figure 3: Smart Camera Software**

Smart cameras are equipped with dynamic software that enables the identification of specific environments, behaviors, and patterns of objects and can alert users based on a pre-programmed criteria to changes in behaviors and patterns of those objects. It can improve the security of open water, coastline, dock and warehouse areas and individual ships that are within the view of surveillance cameras and helps ports comply with the International Ship and Port Facility Security Code and the corresponding U.S. Maritime Security Act. Smart camera software reduces security staffing requirements, procurement and installation costs of cameras and minimizes training time. It helps monitor camera views, dramatically increasing the probability of detecting a security threat, while generating fewer false alarms than conventional video surveillance alone. Instead of attempting to watch a bank of monitors for events, security staff can patrol areas beyond the camera view and respond to alerts from a smart camera software surveillance system as necessary which can be broadcast instantly and automatically to designated e-mail addresses, cell phones, PDAs and alert consoles.

The software can view a scene and determine automatically the type and position of a mobile asset as well as be able to recognize the different elements of the scene where the asset is located. It monitors open water and coastline for watercraft and human activity; tracks people and vehicles moving near secure cargo offloading areas and intermodal connecting points; and looks for objects left behind and for unusual activity near fences and other perimeters, such as people coming and going and vehicles pulling up and stopping. A security official can direct a camera view to focus automatically on an area of interest and within a matter of minutes can implement a rule, quickly creating a virtual barrier around, for example, a ship or cargo container that will trigger an alert if a person enters or exits the area. An official can also set video tripwires to detect the direction of people or vehicles in a designated area, such as pedestrians or watercraft approaching from an unlikely direction, which may be a signal of trouble. A critical functionality for seaports is the software's ability to automatically filter water reflection and tidal action that make video difficult to analyze with the human eye and routinely causes false alarms in other security systems. Security officials can direct the software to look for unusual objects or suspect activity while filtering out activity that is normal for the view, reducing the chance that officials may be required to intervene if nothing unusual is happening.

For example, in a port installation, if a freighter pulls into a berth, the software will recognize the water and channels where ships travel; learn automatically where freighters park and differentiate between a freighter and a small craft. Instead of continuously monitoring an area, the software automatically labels parts of a scene, figures out what is water, what is the berthing area, what is the channel, and understands which rules apply to which assets in those different areas which in turn, enables performance of anomaly detection, query and identification. It provides unattended, accurate 24x7 coverage of critical assets to detect:

- Objects left behind on or near a dock or secure area
- Objects, such as cargo or equipment, removed from a secure area
- People or vehicles entering or leaving a dock, perimeter or other secure area
- Vehicles parked for an extended period of time near a dock or seaport facility
- Smaller watercraft moving in and out of a defined body of water or near a docked container ship

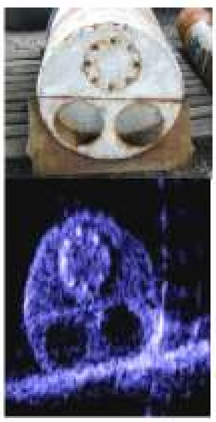
Smart camera software can also be used forensically, allowing security professionals to collect critical intelligence about their security environment based on past events. This function scans days and weeks of pre-recorded video within minutes to locate and extract information about potential security breaches then allows users to run regular queries to detect possible patterns, such as a person casing a perimeter. This enables security professionals to optimize their current surveillance settings to set rules for the future with more accuracy. Because the software allows users to run queries on collected video data, the current surveillance configuration is not jeopardized by testing and implementing new rules.

The integration of smart camera software into the H2S CIS would significantly increase the capability and functionality of the system to improve upon the port and harbor surveillance security.

## II. Underwater Acoustic Devices

Underwater acoustic devices can be used for surveillance, detection, and identification of explosives that have been planted on ships, in harbors and waterways. They significantly increase efficiently in these three areas while reducing the workload and danger to divers who are responsible for port security.

***Photograph and sonar image of mine***



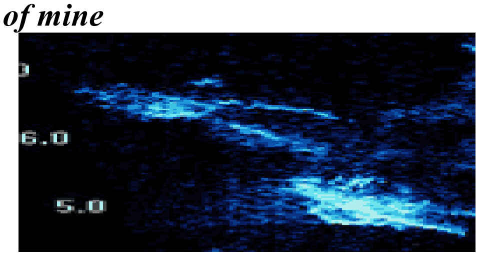



***Image of two divers underwater***

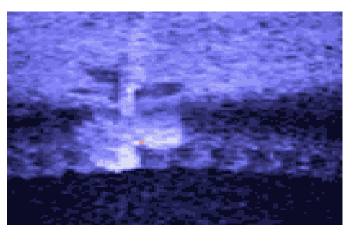


***Image of a propeller on hull***

**Figure 4: Underwater Acoustic Devices**

A grave threat to ports and harbors are mines or improvised explosive devices (IED) placed on ship hulls, piers, berths, and beds of harbors. Underwater detection is predominately carried out by divers. In dark, turbid water their searches require slow, tactile examinations. With the increasing demand for underwater security searches it is imperative that more efficient and effective methods are utilized.

Acoustic cameras that use acoustic lenses and produce almost photographic quality images with sound (sonar) —even in dark, turbid water where optical systems are ineffective have been developed to meet this demand. These acoustic cameras can be configured for operations with remotely operated vehicles (ROVs), autonomous underwater vehicles (AUVs), or divers. When used by divers, the camera system includes high-resolution, head-mounted color display systems. Two versions of the acoustic cameras can be used by divers. The first is a Mine Imaging Sonar (MIS) which is used for detection. The second is the Dual-Frequency Identification Sonar, used for identification.

Pier and dockside underwater security sweeps are typically conducted by 2 divers and take an extensive amount of time to complete. Using a MIS unit one diver can complete the sweep in approximately 15% percent of the time normally required, covering the same area with an increased confidence level of finding potential mines or IEDs. A diver team using two MIS systems completed a hull sweep of an aircraft carrier using 12.5% of the man-hours used in a normal sweep. They also reported a higher confidence level when using the MIS.

**Inspection, positive detection and identification**. Using this technology, divers are able to inspect, positively detect and identify hulls and berthing areas for damage, fouling, contraband, and IEDs in turbid water. Without this technology divers would resort to a search by tactile examination. Divers also like the fact that they can identify objects from a stand-off distance that provides greater safety. Either sonar can also be mounted on a submersible and generate images of objects in turbid water with enough detail that in most cases, a diver would not have to be sent down at all.

**Mobile Surveillance and Monitoring**. A large low-frequency sonar can survey a large volume of water and alert the operator to an approaching underwater object that exhibits characteristics of a threat. The operator directs a patrol boat to that location and the sonar, mounted off the side of the boat is used to identify the target as a diver, delivery vehicle, marine animal, or debris. It can also be used to monitor an underwater location that needs high security, similar to how video surveillance cameras are used on land.

**Fixed Surveillance.** Either type of sonar could observe vessel mobility and interactions in turbid water. Specifically, a sonar can be mounted at a fixed location to observe object movement, including under and above water traffic and to identify aberrant characteristics of that object (e.g. a hull mounted IED). Effectively, this sonar could be used as a security video camera, but used underwater in dark and turbid conditions where optical systems fail.

## III. Biological Aerosol Detectors

Biological and chemical sensors can be use to detect both harmful and harmless biological and chemical substances.

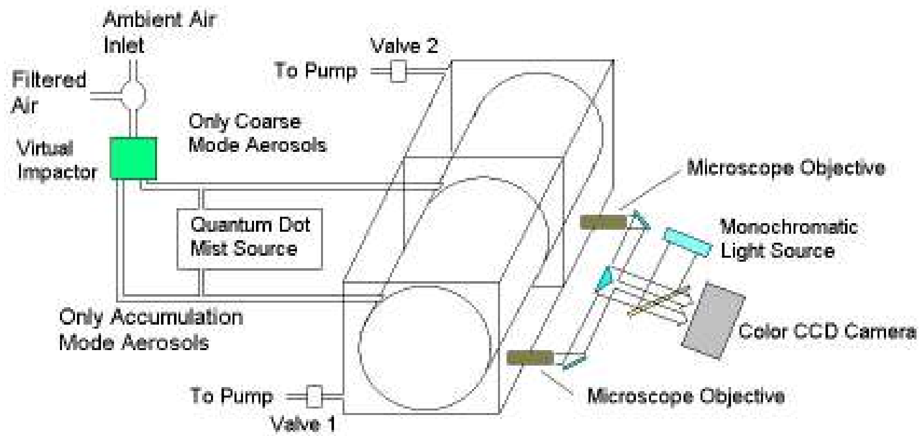



**Figure 5: Bio Trap Schematic**

Biological agents are effective in very low doses. Therefore, biological agent detection systems need to exhibit high sensitivity (i.e., be able to detect very small amounts of biological agents). The complex and rapidly changing environmental background also requires these detection systems to exhibit a high degree of selectivity (i.e., be able to discriminate biological agents from other harmless biological and nonbiological material present in the environment). A third challenge that needs to be addressed is speed or response. These combined requirements provide a significant technical challenge.

Adequate and accurate intelligence is required in order to develop an effective defense against biological warfare. Once an agent has been dispersed, detection of the biological aerosol prior to its arrival over the target in time for personnel to don protective equipment is the best way to minimize or prevent casualties. In the absence of prior warning, detectors collocated with personnel constitute the only means of detecting biological agent attacks prior to the occurrence of disease among its victims.

It is important that a system of sensors be integrated to provide urban environments early detection of biological aerosols. It must be 1) able to detect particulate aerosols in the 2-10 micrometer range, 2) discriminate between biological and non-biological particles, and 3) have low-cost, ruggedized, instruments with small footprints. Key components of the system would also include environmental monitoring, medical monitoring and public health surveillance and can be used in urban environments for early detection of biological aerosols.

A system meeting these specifications is in late stage development and could easily be integrated as a sensor network into the H2S CIS.

## IV. Radiological and Nuclear Sensors

Radiological and sensors can be used to detect both radioactive substances and explosives.

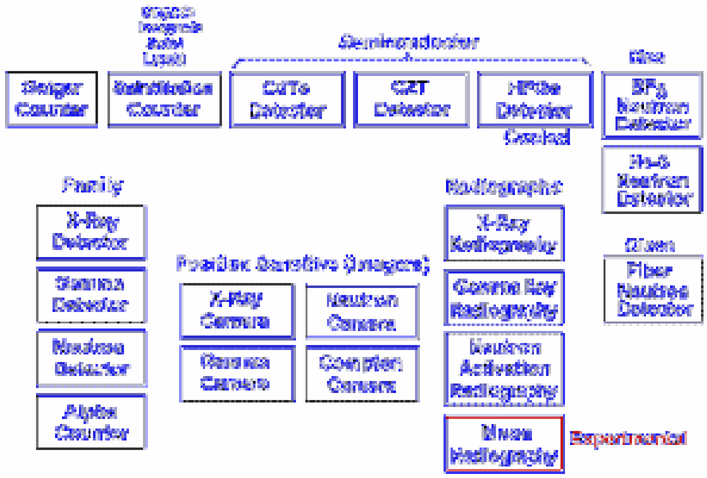



**Figure 6: Types of Radiological and Nuclear Detectors**

Radioactive substances (radionuclides) are known health hazards that emit energetic waves and/or particles that can cause both carcinogenic and non-carcinogenic health effects. Radionuclides pose unique threats to source water supplies and water treatment, storage, or distribution systems because radiation emitted from radionuclides in water systems can affect individuals through several pathways - by direct contact with, ingestion or inhalation of, or external exposure to, the contaminated water.

Threats to water and wastewater facilities from radioactive contamination could involve two major scenarios. First, the facility or its assets could be contaminated, preventing workers from accessing and operating the facility/assets. Second, at drinking water facilities, the water supply could be contaminated, and tainted water could be distributed to users downstream. These two scenarios require different threat reduction strategies. The first scenario requires that facilities monitor for radioactive substances being brought on-site; the second requires that water assets be monitored for radioactive contamination. While the effects of radioactive contamination are basically the same under both threat types, each of these threats requires different types of radiation monitoring and different types of equipment.

A minimal amount of shielding drastically decreases the radiation signature of uranium. Passive radiation detection technologies for shielded highly enriched uranium rely on the detection of impurities whose presence and relative abundance vary widely. Active radiation detection techniques present potential liability issues in public or non-controlled settings and possible safety issues in other settings. In border and portal monitoring situations, active techniques may only be used if personnel are isolated from packages, an operational restriction on deployment. At larger standoff distances, current passive and active radiation detection approaches have very poor sensitivity.

Nuclear sensors need to have the capability to detect, confirm, verify or assure the presence or absence of declared objects or quantities, explosives, special nuclear materials, other radioactive sources or non-nuclear objects in a wide range of containers, from missile tubes to 55 gallon drums to cardboard boxes. They should be man-portable, battery operated and capable of field operation by capable field personnel with a minimum of training.

Integration in H2S CIS of both radiological and nuclear sensors would greatly enhance the capability of the State of Hawaii to monitor and possibly mitigate the threat of a dirty bomb attack.

## V. Radar

***Radar*** is an acronym for Radio Detection and Ranging. It operates in part of the microwave region of the electromagnetic spectrum, specifically in the frequency interval from 40,000 to 300 megahertz (MHz).

A typical radar system consists of the following components:

(1) A pulse generator that discharges timed pulses of microwave/radio energy
(2) A transmitter
(3) A duplexer
(4) A directional antenna that shapes and focuses each pulse into a stream
(5) Returned pulses that the receive antenna picks up and sends to a receiver that converts (and amplifies) them into video signals
(6) A recording device which stores them digitally for later processing and/or produces a real time analog display on a cathode ray tube (CRT) or drives a moving light spot to record on film.

There are a variety of types of radar:

### RADAR

**Figure 7: Microwave Radar**

Microwave radiation, induced by thermal heating, is emitted from the Earth's land, seas, and atmosphere. Passive microwave detectors measure brightness temperatures whose values and variations can be correlated with different materials, e.g., moisture content in soils. An application continuing over the last several decades is determination of sea ice conditions in the Arctic and Antarctic.

### Imaging Radar

Imaging radar plays a vital role in intelligence gathering (IMINT).

**Figure 8: Image of the city of San Francisco**

**<u>S</u>ynthetic <u>A</u>perture <u>R</u>adar (SAR)**

SAR is exclusive to moving platforms. It uses an antenna of much smaller physical dimensions that standard radar, which sends its pulses from different positions as the platform advances, simulating a real aperture by integrating the pulse echos into a composite signal. It is possible through appropriate processing to simulate effective antenna lengths up to 100 m or more.


**Figure 9: SAR Image of Koko Crater and Haunama Bay**

- **Inverse Synthetic Aperture Radar (ISAR)**

ISAR is SAR when the target moves rather than the radar.

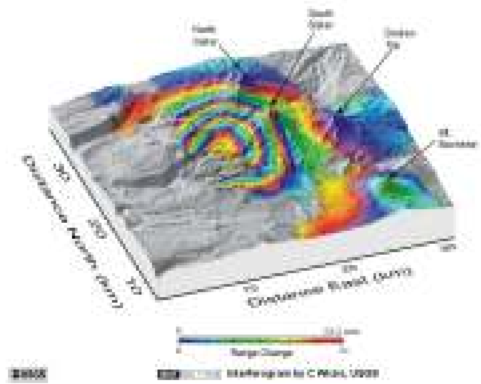


**Figure 10: Inverse Synthetic Aperture Radar Image**

## VI. LIDAR and Laser Plume Detection

**Li**ght **D**etection **a**nd **R**anging, **LIDAR,** like radar, uses reflected energy to determine distance to a target and is appropriate for use in the detection of aerosol and particulate plume dispersion and provide near real-time information to build a common operating picture.

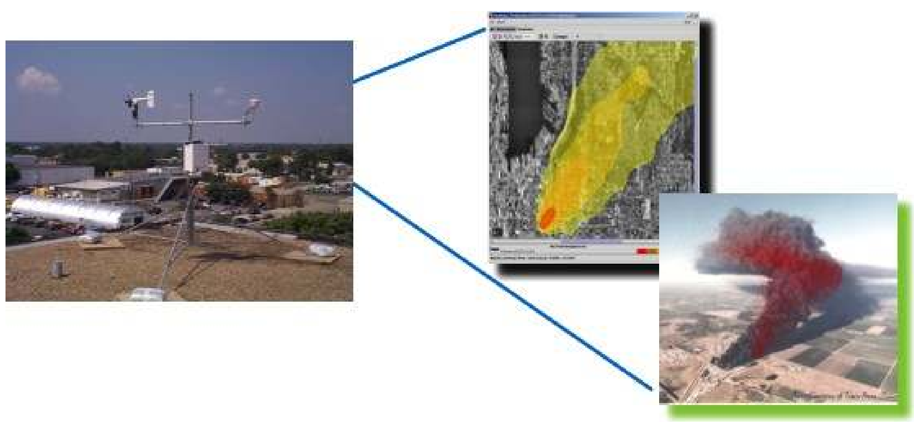


**Figure 11: Use of LIDAR in Plume Detection**

LIDAR can also look at the nature of the reflected signal and determine information about the physical and chemical attributes of the target. Certain lidar wavelengths cause materials to fluoresce or emit light radiation at different wavelengths than that of the incoming beam which tuned detectors can then pick out.

The H2S CIS system currently integrates a marine radar surveillance system using microwave technology; however the incorporation of additional radar technology would significantly enhance the system's port and harbor security capability.

## VII. Aerostats

Basically tethered blimps, aerostats are non-rigid aerodynamic structures manufactured of composite laminates and high-tech materials in combinations that have been refined over years of testing.

**Figure 12: Tethered Aerostats**

The aerostat consists of a flexible structure hull filled with helium (an inert, lighter-than-air gas that is safe and non-burning) and air (in an internal compartment called a ballonet) and associated power and control equipment. The hull is an aerodynamically-shaped balloon up to 71 meters in length, fabricated from a high-strength multi-layer fabric and designed for long term use in all types of environments. An automatic system of sensors, switches, blowers and valves controls the super-pressure within the hull to maintain the external aerodynamic shape.

A single cable called the "tether" maintains the aerostat in its position above the launch point. The tether not only anchors the aerostat in flight, but through electrical conductors embedded in the cable provides power for the electronics payload and other airborne components. Optical fibers are embedded within the tether core in order provide a secure and reliable communications and control link with the ground support system. The fiber optic link provides a secure communications path, free of electromagnetic interference.

**Figure 13: Aerostat with EO/IR Camera**

**Figure 14: Aerostat with Radar**

Aerostat payloads can range from sophisticated sensors, airborne early warning radar systems to VLF/LF communications, active or passive electronic warfare equipment, public emergency broadcasting systems, communications relay and remote control of long range UAVs.

The following payloads have been successfully deployed on aerostats:

- Surveillance radars of all sizes and capabilities
- Signal Intelligence (SIGINT) collection equipment
- Gyro stabilized daylight, low-light level and infra-red video cameras
- Direct television broadcast and relay
- FM radios broadcast and relay
- VHF/UHF, Ground Control Intercept (GCI) and microwave communications
- Environmental monitoring equipment

# Mission Planning

Mission Planning is the ability to define, acquire, and fuse relevant data; and to use the resultant information to enable tactical and situational decision support, communication system management and mission tasking and tracking.

In order to achieve this, the incident command responsible for mission planning must have operator collaboration tools and services to provide the fusion of decision support, situation and resource status management, communications system management and mission/task tracking data. Streaming video, information visualization, and fusion tools are needed as well as modeling and simulation capability, and graphic representation of geo-location of responders with building/ equipment overlay. These tools and services support all hazardous incidents and should be powered from any number of sources including AC/DC, solar and batteries. Commanders need access to all sorts of databases including weather reports. The decision support suite should have an automated mode where it gives problem alerts without being prompted. The system should operate wirelessly and transmit off-site. And finally the cost of the system software could potentially limit the capability.

The capability should include the acquisition, processing, verification, and targeted distribution of intelligence in operational support of incident command. Real-time access to open source information, e.g., mass media and 911 call data; command board data; and security information is required. The intelligence support should provide the ability to fuse all intelligence disciplines including human intelligence, signals intelligence, electronic intelligence, etc. into one location.

H2S CIS is an *information system* designed specifically to gather disparate data and fuse it together to make a common operating picture. The ability of H2S CIS to incorporate that common operating picture into mission planning capability relies on the types of tools developed to enable that functionality.

## Operator Collaboration Tools

The following operator collaboration tools and their function should be developed for integration into a future H2S CIS to provide or support mission planning capability and support multiple CBRNE terrorism prevention and response functions. These include (but are not limited to):

- **Geospatial Analysis** – to allow for association of intelligence and location-based information to perform complex analysis and visualization.
- **Decision Support** – to provide a mechanism to deliver actionable intelligence supporting strategic and tactical operations.
- **Situational Awareness** – to supports a common operational picture with near real-time intelligence fused with geospatial information fully describing the area of operations in a spatial context.
- **Monitoring** (tracking, weather, traffic, assets, environment, damage assessments, disease surveillance)
- **Modeling** – to combine complex spatial information and applies modeling tools to predict consequences of events in support of planning, mitigation, response and recovery.
- **Mapping** – to present fused information in a standard, distributable and easily recognizable format.
- **Reporting** (activity, after action, broadcast alert-warning, location, situation, coverage portrayal)